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ORIGINAL RESEARCH

Assessment of Advanced Practitioner Oncogenomic Training and Proficiency Before and After the Intervention of an Oncogenomic Module

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Abstract

Background: Oncology advanced practitioners (APs) are integral to the daily care of patients with cancer. There is a gap in the literature addressing APs' training in genetics, specifically in baseline oncogenomics. The objective of this study was to evaluate the reported oncogenomic training and proficiency of APs working in hematology/oncology. **Methods:** An interventional pre- and post-test study was conducted with the target population of hematology/oncology APs, which was facilitated through a partnership with the Advanced Practitioner Society for Hematology and Oncology (APSHO). A survey was created to assess demographic variables, oncogenomic training, and concepts of knowledge proficiency among the participants. The intervention was an oncogenomic course. **Results:** 75 participants enrolled in the study, with 37 completing both the pre-test and post-test surveys. 78% of the participants reported limited genetics/genomics training in their master's or doctoral professional programs. 35% of the participants were undecided about access to oncogenomic on-the-job training. Many participants expressed uncertain or limited proficiency with ordering and interpreting tumor genomic profiling for somatic and potential pathogenic germline variants. A statistically significant improvement in the median scores was observed after taking the course in all six of the oncogenomic proficiency statements in the 37 participants who completed the study (t score = −8.841, p value < .001). **Discussion:** This study evaluated the importance of perceived genetics/genomics training in formal and informal educational settings, as well as oncogenomic knowledge in APs working in hematology/oncology. The statistically significant increase in all the oncogenomic proficiency concepts analyzed in the post-test indicates that a focused oncogenomic course for APs is an effective learning strategy.

The foundation of medical oncology therapeutics has transformed with the focus on precision medicine. This field is rapidly evolving given the ongoing discovery of the interrelated pathways of multiomics in the tumor and the surrounding microenvironment (Rulten et al., 2023). The formal education of hematologists/oncologists through fellowship establishes a strong foundation of oncogenomics for current and recent physician graduates. Advanced practitioner (AP) education is typically focused on general medicine, as is the case with physician associates (PAs) and family and adult-gerontology nurse practitioners (NPs). While some new graduates of AP education may have a health-care background in the specialty they choose to practice, many require on-the-job foundational education in their specialty. Oncology APs are integral to the daily care of patients with cancer (Bruinooge et al., 2018). There are increasing numbers of AP post-graduation fellowships within the hematology/oncology specialty at larger academic centers, but this is not nearly sufficient for the hematology/oncology AP workforce (Thomassen, 2018). Many APs receive informal training through gaining work experience in their specialty while collaborating with physicians and AP colleagues (Stewart et al., 2024).

Professional societies like the American Society of Clinical Oncology (ASCO), the American Society of Hematology (ASH), the National Comprehensive Cancer Network (NCCN), and the Advanced Practitioner Society for Hematology and Oncology (APSHO) offer foundational educational resources in addition to updates on the rapidly changing nature of treatment. Access to these training materials usually requires membership dues to the organization and then payment for the courses. Additionally, hematology/oncology educational conferences are held throughout the year that range from broad coverage to subspecialties of the field. Most healthcare systems and practices employing APs supply a stipend and paid time off for continuing medical education (CME; Bruinooge et al., 2018). Even with all these educational resources, it requires ongoing and regular effort by the AP to remain current in oncogenomics and its application to cancer treatment.

A systematic review by Ha et al. (2018) evaluated reported oncogenomic literacy by physicians who predominantly specialized in hematology/oncology and surgical oncology across 21 studies published between 2003 and 2017. The practice-level knowledge of oncogenomics reported by physicians ranged from 20% to 40% throughout the period of the study (Ha et al., 2018). Oncogenomic literacy generally varied across types of testing, with higher confidence reported in ordering somatic testing over germline testing for hereditary cancer syndromes. A gap identified in the literature is the assessment of oncogenomic literacy of APs, including PAs and NPs.

The objective of this study was to evaluate the reported oncogenomic proficiency of APs working in hematology/oncology. The first aim was to assess the baseline of AP-reported oncogenomic training and knowledge proficiency. The second aim was to assess changes in AP-reported oncogenomic knowledge proficiency concepts after completing an online clinical oncogenomic training module. The third aim was to explore potential associations between categorical demographic variables and baseline oncogenomics training and knowledge proficiency concepts.

METHODS

The design of the study was quasi-experimental with pre-test/post-test assessments and an intervention of an online clinical oncogenomic training module. The target study population was PAs and NPs. The study partnered with APSHO to reach the target population of APs in oncology. APSHO has a large membership base consisting of PAs, NPs, clinical nurse specialists, and pharmacists in the field of hematology and oncology. The study was reviewed and deemed exempt status by the Clemson University Institutional Review Board (IRB# 2024-0597).

A survey was created by the study authors, all oncology experts, to assess the oncogenomic training and knowledge proficiency of the participants. A self-assessment survey was selected over the creation of an objective measure to test oncogenomic knowledge, as an objective test would have increased the total time commitment of the study and required validation prior to use in the study. The survey consisted of three sections, with

the first section collecting demographic data. The demographic data included age, gender, and professional items such as job title, years in practice, practice setting, and the number and types of patients seen in practice. Additionally, the participants were queried about caring for patients who have undergone solid tumor sequencing in the past 12 months and if the AP had interpreted and/or explained these results to patients.

The second section assessed the participants' current and previous oncogenomic training opportunities. Questions related to oncogenomic training were measured on a Likert-type scale from 1 to 5, with 1 as "strongly disagree" and 5 as "strongly agree." The items evaluated clinical genetics/genomics training completed in a master's or doctoral program, on-the-job learning through colleagues, CME, and educational programs through pharmaceutical and tumor genomic profiling companies.

The third section evaluated knowledge proficiency based on a Likert-type scale. The proficiency items included ordering tumor genomic profiling, interpreting somatic and potential germline variants on the profiling, explaining tumor genomic profiling to patients, and using results to help guide targeted treatment. The knowledge proficiency items were reevaluated after the intervention of an asynchronous online oncogenomic course.

The analysis of the pre-test and post-test knowledge and proficiency items was performed via paired *t*-test in SPSS. Composite mean scores were calculated for the oncogenomic training and proficiency items. One-way ANOVA testing of the categorical variables with the composite scores was conducted to assess any statistically significant difference in the means.

The intervention for this study consisted of a 90-minute online oncogenomic course that was created by the research team and customized to the audience of APs. Participants were provided information about the voluntary research study and could only proceed with the course after agreeing to the consent. The course was administered through an online learning platform via APSHO. The course was advertised to APSHO members through email and social media sites via a marketing script. Participants who completed the course and the pre/post surveys were entered into a random drawing to win a $25 Amazon gift card. The course was available asynchronously for completion within 30 days from the start date of February 3, 2025.

The oncogenomic training module consisted of a 90-minute prerecorded presentation. The course broadly covered cancer biology and genetics, tumor genomic profiling, and somatic variant-drug pairs. Oncogenes, tumor suppressor genes, oncologic intracellular pathways, and indications for hereditary cancer syndrome screening were reviewed in the cancer biology and genetics section of the course. The tumor genomic profiling section covered indications for ordering testing, an explanation of common information on these reports, and future directions, including epigenomics and transcriptomics. The somatic variant-drug pair section covered common targetable variants such as *EGFR*, *BRCA1*, *BRCA2*, and *PIK3CA*, as well as tumor-agnostic targeted treatment approaches.

RESULTS

Seventy-five participants enrolled in the APSHO-supported study, with 37 participants completing both the pre-test and post-test surveys. Demographic, oncogenomic training, and proficiency data were analyzed for all pre-survey respondents and for the pre-/post-survey respondents, with the latter group used for primary analysis of the study population. The most represented categories were female (92%), NPs (54%), and between 41 and 50 years of age (38%; Table 1). Ninety-five percent of the participants worked clinically in hematology/oncology, with most participants having between 1 and 10 years of experience (73%). Regarding practice type, 32% of participants work in a health system–owned practice, 46% in an academic cancer center, and 19% in a private office. The participants evaluated both new (46%) and established patients (92%); 84% of participants worked outpatient. The types of diagnoses seen by the respondents included benign hematology (59%), malignant hematology (65%), and solid tumors (81%). Most of the participants (89%) have cared for a patient who had tumor genomic profiling, while 65% have interpreted and/or explained tumor genomic profiling with patients.

Table 1. Demographic Data

Demographic	All pre-survey respondents (*n* = 75)	Percentage	Pre-/post-survey respondents (*n* = 37)	Percentage
Age range				
21–30 years old	7	9%	5	14%
31–40 years old	26	35%	11	30%
41–50 years old	24	32%	14	38%
51–60 years old	12	16%	4	11%
61+ years old	6	8%	3	8%
Gender				
Female	70	93%	34	92%
Male	4	5%	3	8%
Prefer not to disclose	1	1%	0	0%
Profession				
Clinical nurse specialist	3	4%	1	3%
Nurse practitioner	58	77%	20	54%
Physician associate	12	16%	9	24%
Pharmacist	2	3%	1	3%
Patient seen per week				
10 or less patients	10	13%	3	8%
11–20 patients	9	12%	5	14%
21–30 patients	13	17%	6	16%
31–40 patients	15	20%	11	30%
41–50 patients	14	19%	6	16%
51–60 patients	5	7%	3	8%
61 or more patients	9	12%	3	8%
Years in practice				
1–5 years	31	41%	15	41%
6–10 years	20	27%	12	32%
11–15 years	8	11%	4	11%
16–20 years	6	8%	1	3%
21–25 years	3	4%	2	5%
26–30 years	2	3%	1	3%
> 31 years	5	7%	2	5%
Practice setting				
Academic cancer center	26	35%	17	46%
Health system-owned practice	27	36%	12	32%
Private office	17	23%	7	19%
Other	5	7%	1	3%
Currently practicing clinically				
Yes	68	91%	35	95%
No	7	9%	2	5%

Table 1. Demographic Data (cont.)				
Taken care of a patient with tumor genomic profiling in the past 12 mo				
Yes	61	81%	33	89%
No	8	11%	3	8%
Not applicable	6	8%	1	3%
Interpreted/explained tumor genomic profiling in the past 12 mo				
Yes	45	60%	24	65%
No	24	32%	12	32%
Not applicable	6	8%	1	3%
Types of patients evaluated				
New patients				
Yes	39	52%	17	46%
No	36	48%	20	54%
Established patients				
Yes	64	85%	34	92%
No	11	15%	3	8%
Outpatient				
Yes	57	76%	31	84%
No	18	24%	6	16%
Inpatient				
Yes	19	25%	14	38%
No	56	75%	23	62%
Benign hematology				
Yes	45	60%	22	59%
No	30	40%	15	41%
Malignant hematology				
Yes	51	68%	24	65%
No	24	32%	13	35%
Solid tumor				
Yes	60	80%	30	81%
No	15	20%	7	19%

The normality of the dataset was assessed by the Shapiro-Wilk test in SPSS, although typically Likert-type data is considered nonparametric. The Shapiro-Wilk test of the four oncogenomic training items and the six oncogenomic proficiency items had test statistics between 0.8 and 0.9, $p < .001$, confirming the dataset was parametric.

The first oncogenomic training item addressed clinical genetics/genomics education in a master's or doctoral program for their profession. Many of the participants reported no training (n = 17, 46%) or limited training (n = 12, 32%) with clinical genetics/genomics in school (Table 2). The second oncogenomic training item assessed for sufficient on-the-job training regarding oncology genetics/genomics with colleagues such as physicians and other APs. Fourteen respondents (38%) reported no to limited on-the-job training, while 13 (35%) were undecided and 10 (27%) reported adequate on-the-job training. The third training statement evaluated the adequacy of currently available oncology genetics/genomics CME programs for APs. Seventeen participants (46%) were undecided about the adequacy of available oncogenomics CME. Interestingly, about an equal number of subjects reported inadequate (n = 7, 19%) and

Table 2. Pre-Survey Oncogenomic Training Responses of Advanced Practitioners Who Completed the Oncogenomics Course

Training item (n = 37)	Strongly disagree (%)	Disagree	Neutral	Agree	Strongly agree
1. I had adequate clinical genetics/genomics education in my master's and/or doctoral program.	17 (46%)	12 (32%)	7 (19%)	1 (3%)	0 (0%)
2. I have adequate on-the-job training with other medical professionals (e.g., physicians, advanced practitioners) regarding oncology genomics.	6 (16%)	8 (22%)	13 (35%)	10 (27%)	0 (0%)
3. There are adequate oncology genetics/genomics courses available currently for continuing education for advanced practitioners.	5 (14%)	7 (19%)	17 (46%)	7 (19%)	1 (3%)
4. There are adequate oncology genetics/genomics educational programs through private companies (e.g., pharmaceutical, and tumor sequencing companies).	3 (8%)	2 (5%)	24 (65%)	8 (22%)	0 (0%)

adequate (n = 7, 19%) availability of oncogenomic CME training. The final training statement assessed the adequacy of oncology genetics/genomics programs through pharmaceutical and tumor sequencing companies. Twenty-four participants (65%) were uncertain about adequate educational training through pharmaceutical and genomic sequencing companies, while 8 participants (22%) reported adequate educational training. The 75 pre-survey respondents' results for the oncogenomic training items overall paralleled the study population results. One exception was that more pre-survey participants reported limited genomics training in professional school programs at 41% (n = 31; Table 3).

One-way ANOVA analysis was performed on the composite means of the training items and the categorical variables of age range, gender, profession, the ranges of patients seen per week, and the ranges of years in practice of the 75 pre-survey participants. There was no statistical significance of the differences in the means of the four training items and the categorical variables (p value range = 0.480–0.984); the p values for significance were set at $< .05$.

The first oncogenomic proficiency item assessed the participants' proficiency at ordering solid tumor sequencing (Table 4). Equal participants reported no or inadequate proficiency (both response categories n = 8, 22%), or were undecided (n = 11, 30%) about proficiency with ordering solid tumor sequencing. Ten subjects (27%) reported proficiency with this concept. The second proficiency item evaluated proficiency with interpreting somatic variants on solid tumor sequencing. Like the first proficiency item, most participants either did not report proficiency (n = 8, 22%) or were undecided (n = 17, 46%) about their proficiency with interpreting somatic variants on tumor sequencing. Only five individuals (14%) reported proficiency with this item. The third proficiency concept analyzed participants' proficiency with interpreting potential pathogenic germline variants on solid tumor sequencing. Thirteen participants (35%) reported no to limited proficiency, while 17 (46%) were uncertain about their proficiency with this concept. The fourth oncogenomic proficiency statement assessed the proficiency of participants in explaining solid tumor sequencing to patients. Many participants were undecided (n = 16, 43%) or expressed proficiency (n = 9, 24%) with this statement. Thirty-two percent of the participants either reported no or limited proficiency (both response categories n = 6, 16%) with this concept. The fifth proficiency item evaluated the participants' ability to use solid tumor sequencing to inform treatment

Table 3. Pre-Survey Oncogenomic Training Responses of All Advanced Practitioners

Training item (*n* = 75)	Strongly disagree (%)	Disagree	Neutral	Agree	Strongly agree
1. I had adequate clinical genetics/genomics education in my master's and/or doctoral program.	32 (43%)	31 (41%)	10 (13%)	1 (1%)	1 (1%)
2. I have adequate on-the-job training with other medical professionals (e.g., physicians, advanced practitioners) regarding oncology genomics.	10 (13%)	21 (28%)	25 (33%)	18 (24%)	1 (1%)
3. There are adequate oncology genetics/genomics courses available currently for continuing education for advanced practitioners.	10 (13%)	18 (24%)	29 (39%)	17 (23%)	1 (1%)
4. There are adequate oncology genetics/genomics educational programs through private companies (e.g., pharmaceutical, and tumor sequencing companies).	4 (5%)	9 (12%)	45 (60%)	16 (21%)	1 (1%)

decisions for patients. The highest-scored responses for this statement indicated uncertainty or some proficiency, with 13 participants (35%) and 10 participants (27%), respectively. Thirty-five percent of participants expressed no proficiency (*n* = 7, 19%) or limited proficiency (*n* = 6, 16%) with the statement. The final oncogenomic proficiency statement analyzed participants' assessment of their ability to use targeted treatments based on a patient's solid tumor sequencing results. Thirty-eight percent of the participants were undecided (*n* = 14), while 24% reported some proficiency (*n* = 9) with this concept. The majority of the remaining respondents reported no or little proficiency (both response categories *n* = 6, 16%) with this statement.

The 75 pre-survey respondents' results for the oncogenomic proficiency items overall paralleled the study population results. However, five respondents in the pre-survey population reported high proficiency with ordering tumor genomic profiling vs. none in the study group (Table 5). More respondents in the study group than in the pre-survey group were undecided about their proficiency with interpreting for somatic and potential germline variants on tumor genomic profiling, with both concepts at 46% (*n* = 17) in the study group vs. 35% (*n* = 26) in the pre-survey group. However, more respondents in the pre-survey group than in the study group reported little proficiency with interpreting for potential germline variants on tumor genomic profiling, 28% (*n* = 21) vs. 16% (*n* = 6). The same proportion of study group participants (*n* = 10, 27%) reported some proficiency with using solid tumor sequencing to inform treatment decisions when compared to the pre-survey population (*n* = 20, 27%). However, more of the pre-survey group (*n* = 25, 33%) than the study group (*n* = 9, 24%) reported some proficiency with using targeted therapeutics based on solid tumor sequencing.

One-way ANOVA testing was performed on the composite means of the proficiency items and the categorical variables of gender, profession, the ranges of age, patients seen per week, and years in practice of the 75 pre-survey participants. There was no statistical significance of the differences in the means of the six oncogenomic proficiency items and the categorical variables (*p* values = .063–.817). However, the one-way ANOVA analysis between the number of years in practice and the composite means of the proficiency items was approaching statistical significance with a *p* value of .063. This suggests that there may be an association between the number of years in practice and reported oncogenomic proficiency in a larger study of the AP population.

Table 4. Pre- and Post-Survey Oncogenomic Proficiency Responses of Advanced Practitioners Who Completed the Oncogenomics Course

Proficiency Item (*n* = 37)	Strongly disagree, *n* (%)	Disagree	Neutral	Agree	Strongly agree
1. I am proficient at ordering solid tumor sequencing.					
Pre-survey	8 (22%)	8 (22%)	11 (30%)	10 (27%)	0 (0%)
Post-survey	0 (0%)	1 (3%)	12 (32%)	19 (51%)	5 (14%)
2. I am proficient at interpreting somatic variants on solid tumor sequencing.					
Pre-survey	7 (19%)	8 (22%)	17 (46%)	5 (14%)	0 (0%)
Post-survey	0 (0%)	1 (3%)	10 (27%)	24 (65%)	2 (5%)
3. I am proficient at interpreting potential germline variants on solid tumor sequencing.					
Pre-survey	7 (19%)	6 (16%)	17 (46%)	7 (19%)	0 (0%)
Post-survey	0 (0%)	2 (5%)	5 (14%)	26 (70%)	4 (11%)
4. I am proficient at explaining solid tumor sequencing results to patients.					
Pre-survey	6 (16%)	6 (16%)	16 (43%)	9 (24%)	0 (0%)
Post-survey	0 (0%)	0 (0%)	10 (27%)	23 (62%)	4 (11%)
5. I am proficient at using solid tumor sequencing to inform treatment decisions for patients.					
Pre-survey	7 (19%)	6 (16%)	13 (35%)	10 (27%)	1 (3%)
Post-survey	0 (0%)	1 (3%)	10 (27%)	21 (57%)	5 (14%)
6. I am proficient with the use of targeted therapeutics based on solid tumor sequencing.					
Pre-survey	6 (16%)	6 (16%)	14 (38%)	9 (24%)	2 (5%)
Post-survey	0 (0%)	3 (8%)	7 (19%)	22 (59%)	5 (14%)

Paired sample *t*-testing was performed to assess for statistical differences in the knowledge proficiency concepts before and after the clinical oncogenomics course for the 37 participants. There was a statistically significant improvement in the median scores before and after taking the course in the oncogenomic proficiency statements (*t* score = –8.841, $p < .001$). The median increased from 2.7 to 3.8 across the six proficiency statements (Table 4). The qualitative responses on the post-survey were generally positive or had constructive criticism. The positive comments centered around the course being informative on the topic, although some expressed that the course did not increase their proficiency, and that more education was needed. The constructive criticism focused on the breadth of the content, with one participant suggesting less broad coverage of the drug-gene pairs.

DISCUSSION

This study evaluated the importance of perceived genetics/genomics training in formal and informal educational settings as well as oncogenomic knowledge in APs working in hematology/oncology. Most APs did not report adequate genetics/genomics training in their master's and/or doctoral programs. This may be in part due to the rapidly changing field of health-care genomics, making it difficult to keep the curriculum current ("We need a genomics-savvy healthcare workforce", 2023). In clinical practice, around one third of APs reported uncertainty about adequate on-the-job training and CME activities on oncogenomics, while only about one quarter agreed that there were adequate opportunities. The perceived lack of formal and informal oncogenomic education for APs illustrates the need for foundational and ongoing learning initiatives. The need for foundational knowledge regarding clinical genetics/genomics is also progressing outside of oncology, in areas such as rare diseases, prenatal care, and cardiology (Brittain et al., 2017). Notably, PAs and NPs both have formal genomic competencies for their professions that cover ordering, interpreting, and implementing findings from genetic testing into practice (Goldgar et al., 2016; Greco et al., 2012).

Table 5. Pre-Survey Oncogenomic Proficiency Responses of All Advanced Practitioners

Proficiency item (*n* = 75)	Strongly disagree, *n* (%)	Disagree	Neutral	Agree	Strongly agree
1. I am proficient at ordering solid tumor sequencing.	12 (16%)	20 (27%)	22 (29%)	16 (21%)	5 (7%)
2. I am proficient at interpreting somatic variants on solid tumor sequencing.	12 (16%)	19 (25%)	26 (35%)	16 (21%)	2 (3%)
3. I am proficient at interpreting potential germline variants on solid tumor sequencing.	12 (16%)	21 (28%)	26 (35%)	13 (17%)	3 (4%)
4. I am proficient at explaining solid tumor sequencing results to patients.	11 (15%)	15 (20%)	27 (36%)	21 (28%)	1 (1%)
5. I am proficient at using solid tumor sequencing to inform treatment decisions for patients.	12 (16%)	15 (20%)	24 (32%)	20 (27%)	4 (5%)
6. I am proficient with the use of targeted therapeutics based on solid tumor sequencing.	11 (15%)	13 (17%)	21 (28%)	25 (33%)	5 (7%)

A survey study on genetics and genomics education of PAs published in 2023 revealed that over two thirds of PA programs do not require an undergraduate genetics course, and many programs have only between 1 and 10 hours dedicated to this topic (Patterson et al., 2023). It is generally accepted that PA and NP training programs have vast areas of content to cover in an expedited period, but this study demonstrates that more effective methods of teaching are required for this clinically imperative knowledge.

One way in which this study addressed this educational gap was by conducting the clinical oncogenomic training module with APSHO. Another way to address CME opportunities is to have educational oncogenomic lectures at AP hematology/oncology conferences like the Journal of the Advanced Practitioner in Oncology Live (JADPRO Live). Emerging techniques for learning, such as microlearning, have had some early success in studies regarding acute lymphoblastic leukemia and sickle cell anemia for physicians, which could be extended to oncogenomics for APs (Deluca et al., 2024; Thordardottir et al., 2024). All participants who completed the post-survey reported that they were interested in future oncogenomic continuing education courses.

Advanced practitioners mostly disagreed or were undecided about proficiency with ordering tumor genomic profiling and interpreting for somatic variants. This is an expected finding, as physicians typically order the testing and meet with patients and families to review the findings as they are directing the oncologic treatment plan. However, APs are embedded in daily oncologic care, and ongoing questions and discussions regarding patient tumor genomic profiling should be expected and addressed by APs. Participants also disagreed or were undecided about interpreting tumor genomic profiling for possible pathogenic germline variants; this can be anticipated as this is a more advanced proficiency concept than the first two concepts. In contrast, a study by Hall et al. (2021) reported that 68% of the 50 physicians who practiced medical oncology, surgical oncology, or gynecologic oncology agreed or strongly agreed that they could interpret and explain secondary pathogenic germline variants to patients.

The majority of the surveyed APs either reported no or limited proficiency or were undecided about their proficiency with explaining solid tumor profiling to patients and using it to inform treatment decisions. Conversely, 20% to 29% reported proficiency with these two concepts. The higher neutral and negative scores were expected and parallel the results of the second proficiency item on the ability to interpret somatic variants. The statistically significant increase in all the

oncogenomic proficiency concepts analyzed by the paired *t*-testing on the post-test indicates that a focused oncogenomic module for APs is an effective learning strategy.

One limitation of this study was the attrition of participants from the pre-survey to completion of the course and post-survey, with about a 49% completion rate. Attrition is an expected issue with pre-test/post-test study designs; in this study, attrition introduced selection bias for the participants who completed the intervention and the post-survey. The length of the educational intervention (90 minutes) may have been perceived as long to the subjects, although the course was able to be completed at the preferred pace of the participant over the 30 days. The small sample size of the study due to attrition could affect the validity of the results by a significant reduction in the statistical power and limit the generalizability of the study findings. The course was asynchronous and available over 30 days; therefore, participants could have accessed other learning materials regarding oncogenomics that may have affected their post-survey responses during that period. Since the post-survey was a self-reassessment of oncogenomic proficiency items on the pre-survey, the subjective reported improvement in proficiency may not translate into actual knowledge or improved clinical practice. Another limitation of the study was the limited representation of PAs and clinical nurse specialists in the study population.

A future extension of this research includes refining and validating the oncogenomic training and knowledge proficiency survey in a larger cohort of APs. Also, it is important to develop an inventory to objectively measure oncogenomic knowledge before and after an educational intervention for APs. Another extension of this study is using different educational interventions, such as in-person learning, live webinars, and written materials.

CONCLUSION

Oncogenomic proficiency is crucial to the comprehensive care of patients with cancer, as therapeutic and prognostic information can often be derived from tumor genomic profiling results. This study highlights oncology APs' perceptions regarding genetics/genomics training in their professional programs, in addition to on-the-job and CME educational offerings. Baseline oncogenomic training and knowledge proficiency of the AP workforce in this clinical field are imperative to inform the improvement of formal and informal AP educational opportunities. Commitment to ongoing oncogenomic education is admittedly a challenging task given the rapid advancement of precision medicine in hematology/oncology, but it is necessary to provide high-quality care to patients with cancer. ●

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